Test Results enclosed!

Testing
for the Presence and Concentration
of Arsenic compounds in Food Samples

Performed by Brandon Swan
Assisted by Tucker Lochrie

WARNING: The following laboratory will be performed using extremely hazardous materials. Improper PPE and ventilation can and will result in various health hazards. Improper storage and disposal can and will result in environmental hazards. Handling and disposal will be fully documented and follow standard procedures to protect ourselves and the Earth.

P65 WARNING: Proposition 65 requires businesses in the State of California to provide warnings for significant exposures to chemicals that cause cancer, birth defects or other reproductive harm. All associated warnings will be listed with the chemical following this message, which should be included for everyone in any continent.

Poison Control USA: 1-800-222-1222
Seek medical attention if any substances contact your eyes, your skin, gets swallowed or inhaled. Keep in mind that each chemical listed has known hazards and their reactions during the test create products in the form of solids and gases which also have their own hazards. First Aide will be provided for less hazardous exposures.

Abstract

On August 5th, 2021, five samples of food-based liquids **all tested negative** for the presence of arsenic compounds. For the dry foods, we saturated the product in distilled water and tested the heterogeneous solutions. The distilled water was also tested separately in case it was contaminated. Without the help of a scanner, it was impossible to truly determine if there was any tiny shift on the indicator. To the naked eye, the results appeared to be less than 1ppb of arsenic per sample or

unchanged at all. These results contradict warnings often posted online that rice and apple based products often contain some levels of arsenic. This conclusion does not mean that other products don't contain arsenic; only that these products here tested negative. There is also the possibility that the test was not conducted appropriately and the test strips were contaminated by moisture which would have rendered them useless. To our knowledge, the test strips remained as dry as possible to avoid this mistake. Therefore, the results appear to be accurate and it is recommended that these and other companies producing food products under public scrutiny for selling food products containing poisons should conduct their own testing. The testing should be forwarded the the appropriate U.S. department regardless of results. Negative results will help inform those with unnecessary concern and may even help improve with sales. Positive results being shared will help ensure changes to help public safety, which will strengthen the reputation and trust in the company's self-conducting tests.

First Aide

- **Accidental Inhalation:** Move to fresh air immediately. If breathing is difficult or coughing persists, contact medical help immediately.
- **Accidental Skin Contact:** Rinse exposed skin with soap and water. Contact medical help immediately if irritation persists.
- **Accidental Eye Contact:** Rinse eyes and remove any contacts gently with water. Seek medical attention if irritation persists or you are concerned.
- **Accidental Mouth Ingestion:** Rinse mouth out and sip water if needed. Do not induce vomiting. If irritation, nausea or vomiting occurs, contact medical help immediately.
- **Additional Note:** Any contact with highly hazardous materials should follow up with a medical professional. That is what they are there for.

Hazards Identification

Tartaric acid is a white, crystalline organic acid that occurs naturally in many fruits, most notably in grapes, but also in bananas, tamarinds, and citrus. (Wikipedia Excerpt).

Compound Name	Tartaric Acid, Lab Grade

Molecular Formula	$C_4H_6O_6$
Manufacturer	**Industrial Test Systems, Inc.**
CAS#	**87-69-4; Global Safety Management, Inc.**

Potassium peroxymonosulfate (also known as MPS, KMPS, potassium monopersulfate, potassium caroate, the trade names Caroat and Oxone, and as non-chlorine shock in the pool and spa industry) is an off-white powder widely used as an oxidizing agent. It is the potassium salt of peroxymonosulfuric acid. (Wikipedia Excerpt)

Compound Name	**Potassium peroymonosulfate**
Molecular Formula	$KHSO_5$
Manufacturer	**Industrial Test Systems, Inc.**
CAS#	**10058-23-8, Santa Cruz Biotechnology, Inc.**

Potassium bisulfate is an inorganic compound with the chemical formula KHSO4 and is the potassium acid salt of sulfuric acid. It is a white, water-soluble solid. (Wikipedia Excerpt)

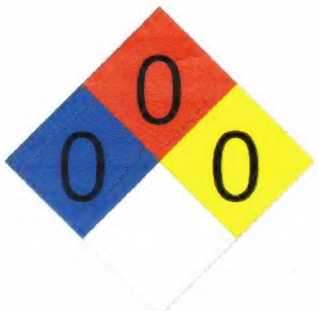
Compound Name	**Potassium bisulfate**
Molecular Formula	$KHSO_4$
Manufacturer	**Industrial Test Systems, Inc.**

CAS#	7778-80-5; Global Safety Management, Inc.

Potassium persulfate is the inorganic compound with the formula K2S2O8. Also known as potassium peroxydisulfate or KPS, it is a white solid that is sparingly soluble in cold water, but dissolves better in warm water. This salt is a powerful oxidant, commonly used to initiate polymerizations. (Wikipedia Excerpt)

Compound Name	Potassium peroxydisulfate
Molecular Formula	$K_2S_2O_8$
Manufacturer	Industrial Test Systems, Inc.
CAS#	7727-21-1; Global Safety Management, Inc.

Magnesium carbonate, Mg CO3 (archaic name magnesia alba), is an inorganic salt that is a white solid. Several hydrated and basic forms of magnesium carbonate also exist as minerals. (Wikipedia Excerpt)



Compound Name	Magnesium Carbonate
Molecular Formula	$MgCO_3$
Manufacturer	Industrial Test Systems, Inc.
CAS#	546-93-0; Global Safety Management, Inc.

Zinc is a chemical element with the symbol Zn and atomic number 30. Zinc is a slightly brittle metal at room temperature and has a silvery-greyish appearance when oxidation is removed.

Compound Name	Zinc
Molecular Formula	Zn
Manufacturer	Industrial Test Systems, Inc.
CAS#	7440-66-6; Global Safety Management, Inc.

Mercury(II) bromide or mercuric bromide is the inorganic compound with the formula HgBr2. This white solid is a laboratory reagent. Like all mercury salts, it is highly toxic. (Wikipedia Excerpt)

Compound Name	Mercuric (II) Bromide
Molecular Formula	$HgBr_2$
Manufacturer	Industrial Test Systems, Inc.
CAS#	7789-47-1; Global Safety Management, Inc.

Hydrogen usually binds with itself to make dihydrogen (H_2) which is very stable, due to its high bond dissociation energy of 435.7 kJ/mol. At standard temperature and pressure, this hydrogen gas

(H_2) has no colour, smell or taste. It is not toxic. It is nonmetal and burns very easily. (Wikipedia Community)

Breathing hydrogen gas directly can cause asphyxiation, which is the lack of oxygen. Otherwise hydrogen is fairly harmless. (Praxair)

Compound Name	Hydrogen Gas
Molecular Formula	H_2
Manufacturer	Lab Test Byproduct
MSDS#	P-4604-G; Praxair, Inc.

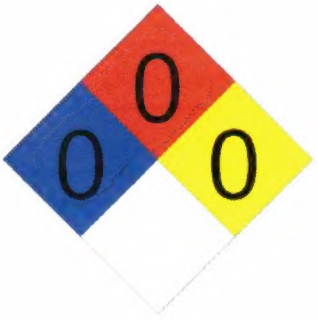
Arsenic Trioxide is a white or transparent, glassy amorphous lumps or crystalline powder. Slightly soluble in water, but dissolves very slowly; more soluble in hot water. Noncombustible. Corrosive to metals in the presence of moisture. Toxic by ingestion.

Compound Name	Arsenic Trioxide
Molecular Formula	As_2O_3
Manufacturer	Lab Test Byproduct as As_4O_6
CAS#	1327-53-3; CAMEO Chemicals

Arsine gas is a colorless gas with a disagreeable garlic odor. Flammable. Heavier than air. Flame easily flashes back to the source of leak. Extremely toxic by inhalation; has been used as a military poison gas. Confirmed human carcinogen. Under prolonged exposure to fire or heat containers may rupture violently and rocket.

Compound Name	Arsine, Gas
Molecular Formula	AsH_3
Manufacturer	Lab Test Byproduct
CAS#	7784-42-1; CAMEO Chemicals

Water is a clear, nontoxic liquid composed of hydrogen and oxygen, essential for life and the most widely used solvent. Include water in a mixture to learn how it could react with other chemicals in the mixture. The U.S. National Academies of Sciences, Engineering, and Medicine determined that an adequate daily fluid intake is: About 15.5 cups (3.7 liters) of fluids a day for men. About 11.5 cups (2.7 liters) of fluids a day for women. Consuming too much water per hour can lead to a condition called Water Intoxication which can be damaging to your brain and possibly fatal. Otherwise water is generally harmless.



Compound Name	Water
Molecular Formula	H_2O
Manufacturer	Lab Test Byproduct
CAS#	7732-18-5; CAMEO Chemicals

Introduction

The purpose of this lab will be to explore whether or not there is any presence of arsenic compounds within a select sample group of food items commonly sold to consumers. The test kit to be used more specifically will test for the presence and concentration of arsenic(III) and arsenic(V) ions, also known as arsenate and arsenite respectively. The test kit being used will display information regarding the results.

Test Kit

Arsenic Quick™ by Industrial Test Systems, Inc.
Rapid Arsenic Test Kit for water analysis
LOT# X2116
Expiration Date: August 2022

Food Items to be Tested

1. **Great Value™ Distilled Water**, 1 Gallon
   Source: Erie County Municipal Water Supply
   Processed by Vapor Distillation
   Distributed by Walmart Inc., Bentonville AR 72716
   UPC# 078742351919
   LOT# 0244
   Expiration: June 18, 2023

2. **Gerber®** Baby Apple Juice from Concentrate
   Product of Argentina
   Distributed by Gerber Products Co. Fremont, MI 49413 USA
   UPC# 015000020712
   LOT# US2071, 0230515791 1515
   Expiration: January 5, 2022

3. **Happybaby®** Mango & Pumpkin Organic Teether Crackers
   Product of Thailand
   Distributed by Nurture Inc., New York, NY 10038 USA
   UPC# 819573015546
   LOT# N 20294
   Expiration: January 20, 2022

4. **River®** Whole Grain Brown Rice, 32oz Bag
   Product of USA
   UPC# 017400105365
   LOT# 347M010, 10:45
   Expiration: December 2022

5. **Goya®** Thai Brown Jasmine Rice, 32oz Bag.
   Product of Thailand
   Distributed by ©Goya Food Inc., Jersey City, NJ 07307 USA
   UPC# 041331026154
   LOT# 025 SG21 SGS NEW CROP 2021
   Expiration: January 2022

Method

The following tests will be using a process known as **Reduction Reaction** which will be conducted for each of the 5 food samples listed above. Each food sample will undergo its own set of 4 main reactions leading to the end result, which is a strip of paper yielding a colour change acting as an indicator. Reduction reaction is a process of transferring around oxygen atoms in a chemical reaction. Such a process is good for chemical reactions which might require solids in a solution or liquids to then become gases.

Essentially in this lab you will be attempting to convert the presence of arsenic compounds in a given food sample from a compound within a liquid based solution, then to a gas, which will react with the mercuric(II) bromide on the test strip to result in a larger mercuric(III) bromide compound now containing arsine ions.

A series of steps created by the test kit's inventor, Ivars Juanakais, will ensure effective results.

Step 1: A reaction bottle is provided in the kit to add the food sample within the threshold of the marked line.

Step 2: a packet labelled Reagent#1 containing Tartaric Acid will be added to the food sample in the bottle and the contents shaken for x seconds. This lowers the pH level in the food sample solution by increasing the number of hydronium ions. Thus paving the way for faster reactions with the compounds of Reagent#2.

Step 3: The next packet labelled Reagent#2 contains the compounds Potassium peroxymonosulfate, Potassium bisulfate, Potassium peroxydisulfate, and Magnesium carbonate. These compounds will attempt to break free Arsenic ions from its environmental compound such as the given food sample solution.

Step 4: At this point the arsenic compound should be converted as best as possible to an arsenic trioxide state. A packet labelled Reagent#3 contains Zinc. When added to the solution containing the food sample blended with Reagents#1 + Reagents#2, the result should end with Zinc losing electrons which results in charging hydrogen to bond with Arsine forming an arsenic gas.

$$Zn + 2H^{+} \rightarrow Zn^{+2} + H_2(g)$$
$$As_4O_6 + 12Zn + 24H^{+} \rightarrow 4AsH_3(g) + 12Zn^{+2} + 6H_2O$$
(Ivars Juanakais, provided by the inventor of the test kit)

Hydrogen and arsenic gases are formed as a result of the reduction reaction. The arsenic gas is then forced through an opening on the Turret cap of the bottle allowing a reaction on the test strip containing mercuric(II) bromide.

$$AsH_3 + 3HgBr_2 \rightarrow As(HgBr)_3 + 3HBr$$

Townsend, Timothy G.; Solo-Gabriele, Helena (2006), Environmental Impacts of Treated Wood, Boca Raton, Florida: CRC Press, p. 339, ISBN 0-8493-6495-7, retrieved 2008-05-29 (courtesy of Wikipedia community)

The mercuric(II) bromide, which is a white colour, converts to an arsenic containing mercuric(III) bromide, which is a yellow to brown colour. This colour change will be compared to a spectrum based diagram indicator. The darker the colour will indicate a higher presence of arsenic ions.

Results

Food Sample	Test Results of Arsenic Ions
Great Value™ Distilled Water	Less than 1ppb or Fully Negative
Gerber® Baby Apple Juice from Concentrate	Less than 1ppb or Fully Negative
Happybaby® Mango & Pumpkin Organic Teether Crackers	Less than 1ppb or Fully Negative
River® Whole Grain Brown Rice	Less than 1ppb or Fully Negative
Goya® Thai Brown Jasmine Rice	Less than 1ppb or Fully Negative

Disposal of Hazardous Waste

Vapors from the lab test were forced outside using a Vornado 293 Heavy-Duty Shop Fan.

Liquids used in the lab test were drained through coffee filters and into a toilet bowl in order to collect as much of the zinc as possible and flush away the rest of the solution. This was a procedure recommended by the representatives of Columbia University who also conducted a similar test. The coffee filters containing zinc will be labelled and stored until it is time to deliver to a facility accepting hazardous wastes.

The used test strips, containing mercury, were placed in zip lock bags to be labelled and stored until it is ready to be delivered to a facility accepting hazardous wastes. Collection date is subject to annual availability. Applicable fees for disposal will be paid in full.

Representatives and Credits

Massachusetts Bay Community College
Brandon Swan (performer of the lab experiment and analysis)
Professor Roy Kennedy (for creating the platform for this experiment)

Salem State University
Tucker Lochrie (for using his skills to assist in this project)

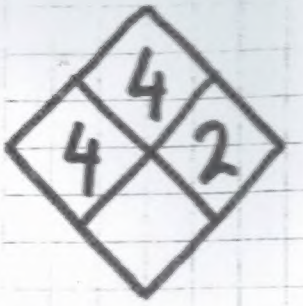
Columbia University
(for their instructional video and disposal technique)
Sara Flanagan
Qiang yang
Yan Zheng

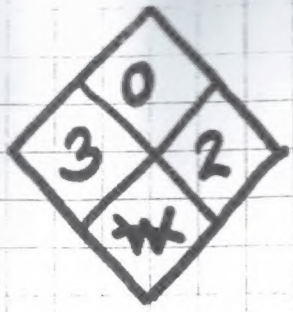
Reviewing Agency

U.S. Food & Drug Administration
10903 New Hampshire Avenue
Silver Spring, MD 20993-0002

NAME Brandon, Swan | Submit to: FDA | DATE | 0 1

LAST NAME Tucker Lochrie | EXAMPLE | FROM PAGE NO





Arsenic gas, Mercuric Bromide; Hazards Summary

Procedure
1. Reagent #1 → 15 seconds (shake)
2. [redacted]MPS → 15 sec. shake → 2 min stand
3. Zinc → 5 seconds shake.
4. Recap with Turret cap + strip.

Results

	µg/L ppb
1. River® Brown Rice	>1
2. Goya® Jasmine Rice	>1
3. Happy Baby® Crackers	>1
4. Gerber® Apple Juice	>1
5. Distilled water	>1

Minuscule trace amounts or less!

SIGNATURE [signature] 06.06.21 DATE | Tucker L WITNESS/TA | 6/5/21 DATE